

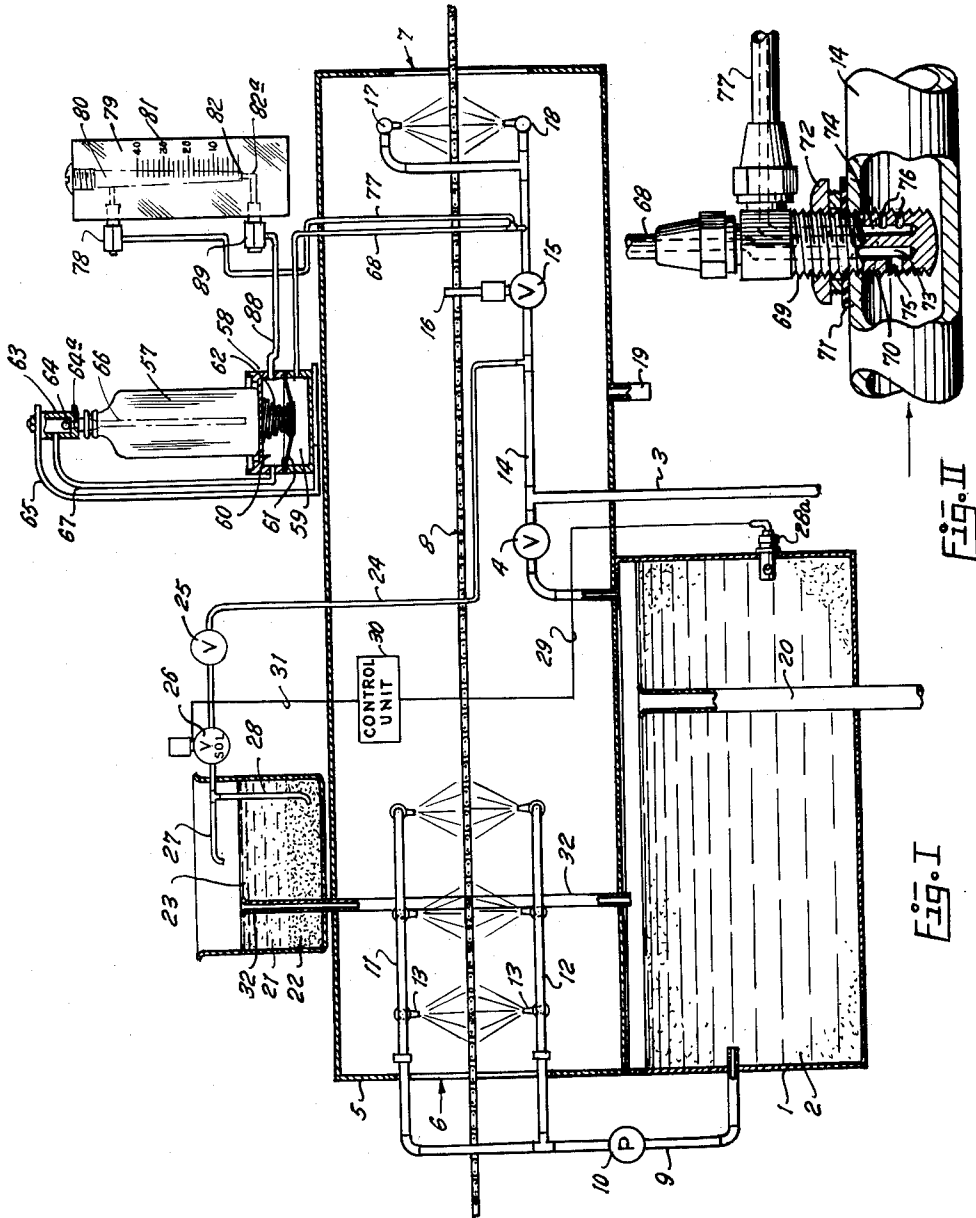
July 7, 1964

G. W. MORAN
DISHWASHER HAVING MEANS TO INJECT LIQUID ADDITIVE
INTO THE RINSE WATER SUPPLY LINE

3,139,890

Filed May 11, 1962

2 Sheets-Sheet 1



INVENTOR.

George W. Moran

BY *Howard E. Moore*

ATTORNEY

July 7, 1964

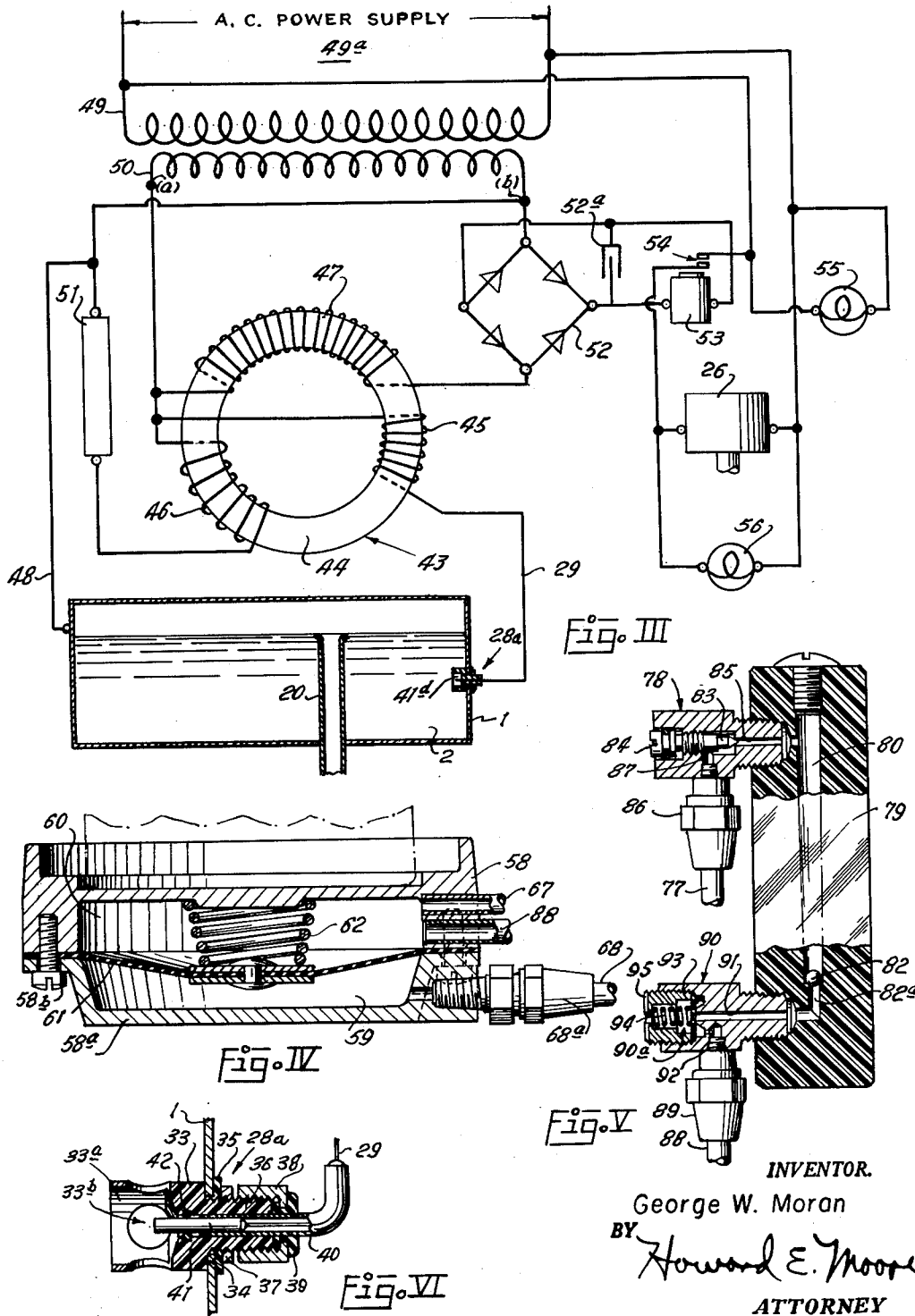
G. W. MORAN

3,139,890

DISHWASHER HAVING MEANS TO INJECT LIQUID ADDITIVE
INTO THE RINSE WATER SUPPLY LINE

Filed May 11, 1962

2 Sheets-Sheet 2



1

2

3,139,890

DISHWASHER HAVING MEANS TO INJECT LIQUID ADDITIVE INTO THE RINSE WATER SUPPLY LINE

George Wenzel Moran, 4914 Cole Ave., Dallas, Tex.

Filed May 11, 1962, Ser. No. 194,025

6 Claims. (Cl. 134-100)

This invention is concerned with improvements in commercial type dishwashing machines and is particularly concerned with improvements in means for controlling the detergent concentration and dispensing thereof into the wash water, and for injecting a surface tension lowering additive into rinse water as the rinse water flows through the rinse water conduit enroute to the rinse spray jets.

Conventional commercial dishwashing machines now known to the trade are primarily used in restaurants, hotels, and institutions. Such dishwashing machines normally include means for moving trays or racks of dishes through an enclosed housing where the dishes are exposed to a jetted spray of circulating water and detergent solution, which is generally referred to as the wash water, which is followed by a single or final spray of clean rinse water which preferably has a surface tension reducing additive therein to prevent spotting of the dishes.

It is important to maintain a suitable and sufficient amount of detergent in the wash water solution to facilitate removal of grease and other soil from the dishes, and to prevent the forming of lime, scale or other mineral deposits on the dishes.

It is also important to provide for the injection of a suitable and measured quantity of surface tension reducing additive into the final rinse water, so that substantially all the rinse water drains from the surface of the dishes upon removal from the rinse spray where they are dried by air. Without the surface tension reducing additive, the final rinse water tends to cling to the dishes in the form of droplets which increases the time required for air drying and results in circular spots on the dishes left by mineral deposits in the water upon evaporation of the droplet. This is particularly prevalent in hard water areas.

This invention is particularly concerned with that type of dishwashing machine wherein the dishes are conveyed through the machine on a conveyor in a continuous movement, wherein they are first exposed to jetted wash water spray, and are then exposed to the final rinse spray. As the trays enter the rinse section they engage and actuate a switch arm which in turn opens the rinse water valve, allowing the rinse water to spray over the dishes as the trays pass through the rinse water section. Thus the rinse water jets are turned on and off intermittently.

After the rinse water passes over the dishes, it may be directed into the wash water tank, which in turn has an overflow into the sewer outlet. In any event, water is continuously added to the wash water tank either from the rinse water or from the fresh water source, and overflows into an outlet to the sewer, thereby taking off floating grease and food particles into the sewer.

Such constant addition of water to the wash water container dilutes the detergent concentration of the wash water, thus making it necessary, if the detergent concentration is to remain uniform and effective, that means be provided to intermittently add detergent to the wash water in sufficient quantities to compensate for the dilution, and to compensate for the detergent consumed in cleaning the dishes.

Likewise, it is desirable that the rinse additive in the rinse water remain uniform in amount at all times so that it is necessary and desirable that some means be provided to inject the rinse additive into the rinse water sup-

ply pipe substantially in proportion to the volume flow of rinse water to the rinse water jets.

A primary object of the invention is to provide in such a dishwashing machine means for automatically injecting surface tension lowering additive into the rinse water supply line at a predetermined rate and amount in proportion to the volume flow of rinse water through the rinse water conduit.

A further object of the invention is to provide means for adjusting the amount of surface tension lowering additive added to the rinse water.

Still another object of the invention is to provide means for preventing the siphoning of surface tension lowering additive out of the container therefor into the rinse water line while the machine is not in operation.

A suitable embodiment of the invention is shown in the attached drawings, wherein:

FIGURE I is a side elevational view, partially in cross-section, and partially diagrammatic, showing the dish washing machine with the improvements comprehended by this invention incorporated therein;

FIGURE II is a fragmentary side elevational view, partially in cross-section, showing the rinse water additive differential producing and injecting fitting adjustably extending into the rinse water line;

FIGURE III is a schematic and diagrammatic view of the electrical circuit for automatically controlling the injection of detergent into the wash water tank;

FIGURE IV is a cross-sectional, elevational view of the diaphragm chamber employed as a part of the rinse water additive injection mechanism;

FIGURE V is a cross-sectional, elevational view of the flow meter control valve and the non-siphoning valve employed in connection with the rinse water additive injection mechanism; and

FIGURE VI is a cross-sectional, elevational view of the mounting for the adjustable electrode which extends into the wash water tank for adjusting the amount of detergent dispensed into the wash water tank.

Numeral references are employed to designate the various parts shown in the drawings, and like numerals indicate like parts throughout the various figures of the drawings.

The numeral 1 indicates the wash water tank which contains a quantity of water and detergent solution 2, the level of which is controlled by the overflow pipe 20 which leads to the sewer.

Fresh water may be supplied to the wash water tank 1 through a hot water supply line 3, the flow through which is controlled by a manually operable fill valve 4.

The dish washer device includes a substantially rectangular housing 5 having an inlet opening 6, and an outlet opening 7, in the ends thereof through which there passes an endless chain conveyor 8 on which trays or other receptacles of dishes may be disposed for passage through the housing 5 in continuous movement.

A wash water circulating pipe 9 extends through a wall of the tank 1, and has connected therein a pump 10 for withdrawing wash water 2 from the tank 1 and circulating same through the distributor pipes 11 and 12, and through the jet spray heads 13 for ejection of wash water and detergent mixture under pressure in the form of spray against the dishes, trays, or other elements as they pass therethrough on the conveyor 8.

A rinse water supply line 14 is connected to the hot water supply line 3, the flow therethrough being controlled by a valve 15 which is actuated by engagement of the dish trays or receptacles with the switch arm 16 as they pass same on the conveyor 8.

When the valve 15 is thus actuated, the rinse water supply line 14 is opened, supplying rinse water under pressure to the spray heads 17 and 18, from which are

emitted rinse water under pressure in the form of a spray over and about the dishes or other articles moving along on the conveyor 8.

The wash water and the rinse water, after passing over the dishes on the conveyor 8, falls to the bottom of the housing 5 and flows into the wash water tank or out through the passage provided by the drain pipe 19.

A detergent container 21 is mounted above the wash water tank 1 and has disposed therein a quantity of detergent 22 which is normally placed in the tank 21 in powdered form (but may be in liquid form). The detergent 22 is mixed with water 23, supplied to the detergent tank 21 through a water supply line 24, which is connected at one end to the fresh water supply line 14, and communicates with the tank 21 through the hand control valve 25, and the solenoid valve 26. The operation of the solenoid valve 26 will be hereinafter described.

When the hand valve 25 and the solenoid valve 26 are opened, fresh, hot water is supplied to the tank 21 through the water dispersal pipes 27 and 28. The pipe 27, being disposed above the surface of the water and detergent mixture in the tank 21, and the dispersal pipe 28 being disposed near the bottom thereof, the ejection of water under pressure from the dispersal pipes 27 and 28 will create turbulence in the water 23 and detergent 22 to cause the mixing thereof in the event the detergent 22 has settled to the bottom of the tank during the time when no water is being injected into the tank.

Upon injection of water into the tank 21 through the dispersal outlets 27 and 28, the water and detergent 22 and 23 therein are mixed, and caused to overflow through the overflow line 32 into the wash water tank 1, to thereby become mixed with the wash water and detergent mixture 2 in the wash water tank 1.

The injection of water into the detergent supply tank 21 is intermittent and is controlled by the concentration of detergent in the fluid 2 in wash water tank 1.

This is so by reason of the fact that an adjustable electrode 28a is extended through the wall of the wash water tank 1 with the inner end thereof exposed to the liquid 2. Said electrode 28a is electrically connected to a control unit 30 through a suitable electrical lead 29. The control unit 30, hereinafter described, controls the opening and closing of the solenoid valve 26, and therefore the flow of water through the line 24.

Referring to FIGURE VI, showing the construction and mounting of the control electrode, the control electrode 41 is slidably and sealingly disposed through the wall of the wash water container 1, and is insulated from the wall of the metal container 1, but is in electrical contact with the fluid in the tank 1. Electrode 41 is preferably made of carbon composition or other non-corrosive conducting material.

The electrode 41 is mounted in a jacket 40 which slidably extends through a bore extending through the insulator bushing 33. The insulator bushing 33 has a shoulder 34 thereon which is abutted against the inner surface of a wall of the tank 1, and has a hollow extension 33a thereon with openings 33b provided therein to protect and at the same time expose the inner end of the electrode 41 to the fluid in the tank 1.

The insulator bushing 33 is provided with a threaded extension 36 extending through a passage through the wall of the tank 1, and a resilient seal ring 35 is abutted and compressed against the outer wall of the tank 1 in sealing engagement therewith by a seal gland 37 threaded about the extension 36.

A cap 38 is threaded onto the outer end of the extension 36.

A seal grommet 39, made of resilient sealing material, has a flange on the inner end thereof compressed between the annular shoulder of the cap 38 and the outer end of the extension 36, and has an end, annular flange abutted against the outer face of the seal gland 38 to provide a

sealed and slidable connection between the sleeve 40 and the central passage through the seal grommet 39.

The inner end of the electrode 41, which has an enlarged diameter, slidably extends through a seal ring 42.

Thus it will be seen that the electrode 41 may be moved inwardly and outwardly of the interior of the tank 1 so that more or less of the surface thereof will be exposed to the fluid 2 in the tank.

Since the various salts comprising the detergent readily ionize when dissolved in water, the water in the wash tank 1 becomes a reasonably good conductor of electricity when a small amount of detergent is added. Up to a point (a quite high concentration), the conductivity of this solution increases substantially in proportion to the amount of detergent added. Likewise, with a given concentration and a given potential, and up to a point, the greater the area of the electrodes that are exposed to the solution, the greater will be the flow of electricity through the solution. In this instance the metal walls of wash water tank 1 acts as one electrode and the electrode 41, just described, acts as the other. Thus, with a given potential, the flow of electrical current passing through the wash water solution will be governed by (a) the detergent concentration of the solution, and (b) the area of the electrode 41, exposed to the solution.

Referring now to control unit 30, and FIGURE III, the magnetic amplifier 43 includes a tape wound iron core 44, having a substantially rectangular hysteresis loop, or an iron core consisting of thin laminations having a substantially rectangular hysteresis loop, a load winding 47, a control winding 45 and a bias winding 46. The load winding 47 is connected at (a) to one end of the secondary winding 50 of power transformer 49a, and the other end leads through the full wave rectifier circuit 52 and the relay 53 and is connected at (b) to the other end of the secondary winding 50.

The control winding 45 is connected to one end of the secondary winding 50 of transformer 49a at (a), and the other end thereof leads through the adjustable electrode 41, through the wash water 2 to the wall of wash water tank 1, and to the other end (b) of secondary winding 50.

The bias winding 46 is connected on one end at (a) to secondary winding 50, and the other end leads through resistor 51 and is connected at (b) to the other end of secondary winding 50.

The number of turns in load winding 47 and the cross section of the iron core 44 are arranged so that when energized through the secondary winding 50 the core 44 is just below saturation point, and the uni-directional current passing through the relay 53 is just below that required to hold the relay in actuated position, thus allowing contact 54 to remain closed. Control winding 45 has relatively few turns compared to the number of turns in load winding 47. Bias winding 46 has preferably the same number of turns as control winding 45, but is oppositely wound so that when energized the current in winding 46 runs counter to the direction in which the current flows in windings 47 and 45, but due to resistance 51 does not completely offset current in winding 45. The resistance 51 is so set that a small increase in current flow through windings 45 will saturate core 44 to the extent that it will allow a greatly increased and sufficient additional current to flow through load winding 47 to activate relay 53, thus opening contacts 54. Conversely a small decrease in current flow through winding 45 will decrease current flow through load winding 47 below that required to activate relay 53 and will thus allow contacts 54 to close.

One end of the winding of solenoid valve 26 is connected to one terminal of the A.C. power supply and the other end is connected to one of the control points 54 of relay 53. The other contact point of the relay 53 is connected to the other terminal of the A.C. power supply. When the relay 53 is de-activated, the contact points 54

are closed, which energizes solenoid valve 26 and opens same.

Thus when the detergent concentration in water 2 becomes great enough to allow sufficient conduction of current through the circuit including the electrode 41, the water, the wall of the tank 1 and control winding 45 to saturate core 44 and energize relay 53, the contacts 54 will be broken to close solenoid valve 26 and cut off further supply of fresh water to tank 21 and therefore overflow of detergent mixture through pipe 32 into tank 1. When the detergent concentration in water 2 becomes low enough to not support conduction sufficiently to allow sufficient flow of current to relay 53 to hold same activated, same will be de-activated, the contacts 54 will close and solenoid valve 26 will be energized and opened to allow fresh water flow into tank 21 and supply of detergent to wash water 2. This cycle is continuously repeated while the dishwasher is in operation.

The amount of detergent dispensed into the wash water 2 may be controlled by pushing the electrode 41 into or out of tank 1, thereby exposing more or less of the surface of the electrode to the detergent solution in the tank.

The rinse water additive container 57 is arranged to contain a quantity of surface tension lowering additive to be injected into the rinse water supply line 14 as hereinafter described.

The container 57 is arranged to be seated on top of a diaphragm housing 58, said diaphragm housing 58 including a detachable lower wall 58a, which may be secured to the upper portion of the diaphragm housing by screws 58b, to clamp the edge of a flexible diaphragm 61 between the upper and lower portions of the diaphragm chamber, thereby providing a lower diaphragm chamber 59 and an upper diaphragm chamber 60.

The diaphragm 61 is normally urged downwardly by the spring 62, as shown in FIG. IV.

A check valve housing 63 having a fluid actuated ball check valve 64 therein, is supported above the upper opening of container 57 by means of a bracket arm 65 which may be secured at its lower end to the diaphragm housing 58.

A hollow tube 66 extends below the valve seat 64a into the container 57.

A hollow tubular conduit 67 provides communication between the check valve housing 63 and the upper diaphragm chamber 60.

A tubular conduit 68 is connected through a suitable fitting 68a in communication with the lower diaphragm chamber 59, and the other end thereof is connected to the special pressure differential and additive injection fitting 69.

The fitting 69 has a threaded end 70 which is threaded through an opening in the wall of the rinse water supply conduit 14. A resilient seal 71 is provided about the fitting 69, and is compressed into sealing engagement about the fitting by an interiorly threaded gland 72 which may be tightened downwardly thereon to expand same into sealing engagement.

The fitting 69 has two parallel longitudinal passages 73 and 74 therein, the passage 73 communicating with the conduit 68 and the passage 74 communicating with the conduit 77. An inlet passage 75 is provided through the wall of the fitting 69 in position so that it is exposed to the direct pressure of the flow of rinse water in the conduit 14, and it faces the direction of such flow, which is indicated by arrow in FIG. II. The passage 75 communicates with the longitudinal passage 73, so that pressure in the rinse water supply line 14 is conveyed through the passage 75 and passage 73 and conduit 68 to the lower diaphragm chamber 59.

A pair of orifices 76 are provided through the wall of the fitting 69, which communicate with the longitudinal passage 74 in fitting 69. The orifices 76 are much

smaller in cross-sectional area than the orifice 75 for the purposes hereinafter mentioned.

It will be seen that communication is provided through orifices 76, longitudinal passage 74, and conduit 77 to the control valve 78.

The flow meter 79 has a tapered bore 80 therein with graduation scale 81 on the outer face thereof. The body of the flow meter 79 is preferably made of transparent plastic material so that the graduation scale can be read in conjunction with the ball valve 82 to determine the flow rate in the injection line 77. The ball float valve is arranged to open and close the passage 82a, leading into the bore 80 for the purpose hereinafter mentioned.

The manually adjustable control valve 78 includes a valve head 83 which is arranged to close the passage 85 through the control valve body 78 to cut off or regulate the flow of fluid from the bore 80 through the control valve 78. The control valve head 83 may be moved inwardly and outwardly by turning the threaded adjustment head 84.

The fitting 86 is secured to the additive injection line 77, and is screwed into a passage through the wall of the control valve body 78, and has a bore therethrough arranged to communicate with the passage 87, to thereby provide communication between the additive injection line 77 and the bore 80 which is controlled by the valve head 83.

A conduit 88 is attached to communicate at one end with the upper diaphragm chamber 60, and at the other end is attached to a fitting 89, which is screwed into a passage through the wall of the anti-siphoning control valve 90, so that the bore therethrough and the conduit 88 communicates with a passage 92 provided in the body parallel to the central bore 91 through the body 90.

A flexible flat diaphragm 93 is disposed in the bore 90a of the body 90, and is normally urged inwardly to close the passages 92 and 91 by a spring 94. The spring 94 is held in place by a spring retainer 95 which is threaded into the bore 98 of fitting 90. This spring retainer serves to seal the outer edge of diaphragm 93.

The operation and function of the surface tension lessening additive injection mechanism immediately hereinafter described is as follows:

When a tray of dishes or the like engages the switch arm 16 and actuates the valve 15 to open same, thereby opening the rinse water injection line 14 to the spray heads 17 and 18, the water flows through the line 14 under pressure enters the passage 75, is transferred through the passage 73 and line 68 to the lower diaphragm chamber 61. Such pressure pushes the diaphragm 59 upwardly against the spring 62. The upper diaphragm chamber 60 has been previously filled with non-spotting additive from the container 57 through the tube 67 in the manner hereinafter described. Therefore, when the diaphragm 59 is moved upwardly, the additive liquid in the upper chamber 60 is forced outwardly through the conduit 88, and expands the diaphragm 93 against the spring 94, allowing the additive fluid to pass through the passage 92 and 91, lift the check valve ball 82 off of its seat, permitting the additive fluid to pass through the bore 80, passage 85 and 87, and additive injection line 77, through longitudinal passage 74, and outwardly through the restricted orifices 76 into the rinse water supply line. Due to the differential in pressure caused by the obstruction of member 70 in the direction of flow and the difference in size of orifices 75 and 76, the flow immediately hereinbefore explained is facilitated and the additive is jetted through the orifices 76, into the rinse water flow stream. The additive thus becomes mixed with the rinse water as it passes to the spray heads 17 and 18, where it is applied to the surface of the dishes being rinsed.

When the arm 16 is released, the valve 15 closes, thereby closing the rinse injection line 14. This equalizes the pressure in the chambers 60 and 59, and the spring 62 relaxes to push the diaphragm 61 downwardly, thereby

creating a vacuum in the upper chamber 60, drawing additional additive fluid from the container 57 into the upper chamber 60, to refill same.

In such refilling action, the check valve 64 is lifted off its seat to allow the additive fluid to flow through the line 67 to the upper diaphragm chamber 60. However, when rinse water is flowing through the rinse water supply line 14 to supply pressure below the diaphragm chamber 59, the additive fluid in chamber 60 is prevented from flowing back into the container 57 by reason of the seated check valve ball 64.

The flow of additive injected into the line 77 may be determined by the position of the check valve ball 82 on the scale 81, and such flow, and therefore the rate of injection of additive fluid into the rinse water line may be regulated by adjustment of the manual valve 83. The pressure applied to the lower diaphragm chamber 59 may also be regulated by screwing the threaded portion 70 of the fitting 69 into or out of the bore of the rinse water supply line 14, thereby exposing the passage 75 to greater or lesser pressure and regulating the differential in pressure across the threaded portion 70. This adjustment is important in that it will control the amount of flexure of the diaphragm 61 and therefore the amount of additive fluid drawn into the upper chamber 60 and injected into the line 77.

When the dishwasher is not in operation, additive fluid is prevented from being siphoned from the upper diaphragm chamber 60 through lines 88 by the anti-siphoning valve arrangement indicated generally at 90. This is so by reason of the fact that the spring 94 holds the resilient seal ring 93 in sealing engagement across the passages 91 and 92 until a positive pressure is exerted against the diaphragm to overcome the spring by pressure injected to the lower diaphragm chamber 59 from the rinse water supply line 14, as hereinbefore described. Therefore, no additive is lost by siphoning action while the dishwasher machine is not in operation. This is an important feature because such additive is quite expensive.

A pilot light 55 is connected across the primary 49 of the power transformer, to indicate when the power is on; and a pilot light 56 is connected across the solenoid valve 26 to indicate when the solenoid valve is open to supply detergent to the wash water tank 1. The capacitor 52a smooths out the D.C. current supplied to relay 53.

It will thus be seen that I have provided in a commercial type dishwasher machine means for automatically injecting into the wash water solution a measured quantity of detergent depending upon the demand therefor, wherein the injection rate and amount may be adjusted, and I have provided means for automatically injecting surface tension lowering additive fluid into the rinse water line in measured and controlled amounts depending upon the requirements, and have provided means preventing the loss of additive by siphoning action while the dishwasher is not in operation.

Having described my invention, I claim:

1. The combination with a dishwashing machine having a housing adapted to receive dishes, rinse water spray heads disposed in the housing, a rinse water supply line

connected to the spray heads, a valve in the supply line for controlling the flow of rinse water to the spray heads for rinsing the dishes, means for operating said valve to control the flow of rinse water through the supply line; of means for injecting liquid additive into the rinse water supply line when the valve is open including, a fitting extending into the rinse water supply line; a first longitudinal passage through the fitting; a first lateral orifice through the wall of the fitting communicating with said first longitudinal passage; a diaphragm chamber divided into upper and lower chambers by a horizontal diaphragm member, with the first longitudinal passage communicating with the lower chamber; spring means in the upper chamber normally urging the diaphragm downwardly; a liquid additive container; a flow line leading from the container to the upper chamber; an upwardly opening check valve controlling communication from the container to the upper chamber; a conduit leading from the upper chamber to the fitting; a second longitudinal passage in said fitting communicating with the conduit and a second lateral orifice through the wall of the fitting communicating with the second longitudinal passage.

2. The combination called for in claim 1 with the addition of means in the conduit to indicate the rate of flow of additive through the conduit.

3. The combination called for in claim 1 with the addition of means in the conduit to prevent the siphoning of fluid from the upper chamber through the conduit when no pressure is applied to the lower diaphragm chamber.

4. The combination called for in claim 3 wherein the means to prevent siphoning of fluid from the upper chamber includes a fitting in the conduit having parallel passages therethrough; a flexible diaphragm positioned over the passages; spring means normally pressing the diaphragm against the openings to said passages to close same, whereby pressure in the conduit will expand the diaphragm against the spring means to allow communication between the passages.

5. The combination called for in claim 1 wherein the first named orifice faces the direction of flow in the line and the second named orifice faces away from the direction of flow and is smaller in diameter than the first named orifice.

6. The combination called for in claim 1 wherein the fitting adjustably extends through the wall of the rinse water line, whereby the extent of extension thereinto may be adjusted.

References Cited in the file of this patent

UNITED STATES PATENTS

1,462,735	Blakeslee	July 24, 1923
1,678,781	Ladd et al.	July 31, 1928
2,155,254	Clark	Apr. 18, 1939
2,266,205	Hunter	Dec. 16, 1941
2,578,994	Dunaway	Dec. 18, 1951
2,746,465	Farison	May 22, 1956
2,770,242	Tubiolo	Nov. 13, 1956
2,832,366	Farison	Apr. 29, 1958
2,910,075	Federighi et al.	Oct. 27, 1959
2,949,120	Federighi et al.	Aug. 16, 1960